Basic Geodesy

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Non-Earth-Centered versus Earth-Centered Ellipsoids

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Ellipsoid models are good approximations of the true shape of the earth. There have been many ellipsoid models developed for the earth, and other than the earliest ones, such as Everest and Bessel ellipsoids; the differences between them are very small as can be seen in the table below.

Ellipsoid Name	a (meters)	1/f
Clarke 1866	6378206.4	294.9786982
International 1924	6378388	297
WGS 84	6378137	298.257223563

"a" is the semi-major axis. "1/f" is the reciprocal of flattening. WGS 84 is the World Geodetic System 1984 ellipsoid.

There are two types of ellipsoids; earth-centered and non-earth centered ellipsoids. Before World War II, all of the ellipsoids were non-earth centered ellipsoids. Since the earth is irregular shaped and an ellipsoid does not perfectly fit the earth, early maps were created by mathematically moving the ellipsoid to better fit the area of the earth being mapped. An example is illustrated in Figure 1. When the International 1924 ellipsoid, a non-earth centered ellipsoid, was used for mapping western Europe, it was moved to better fit that area. Note how poorly the ellipsoid fits the Colombia, South America area of the world. However, if the ellipsoid is moved to better fit Colombia, South America, as shown in the lower right of Figure 1, it fits very poorly in Western Europe.

The subject of datums, such as European Datum 1950 (ED 50) and Provisional South American Datum 1956 (PSAD 56), will be covered in a future article.

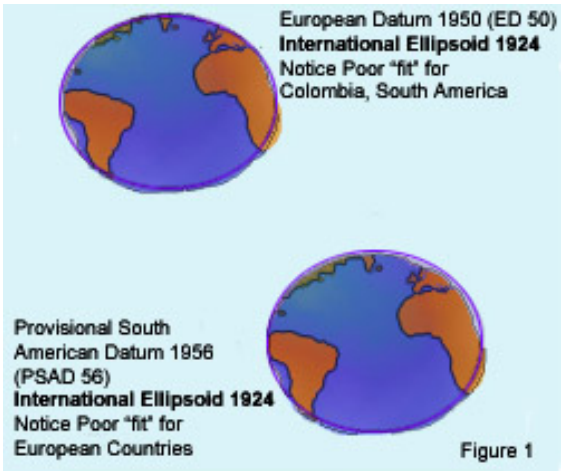

Figure 1

Once satellites were launched, geodesists and other scientists were able to determine the size and shape of the earth along with the center of mass of the earth with better accuracy. All of the World Geodetic System (WGS) ellipsoids, such as WGS 66, WGS 72, and WGS 84 are earth-centered ellipsoids along with the Geodetic Reference System 1980 (GRS 80) ellipsoid. These ellipsoids are positioned about the center of mass of the earth. (See Figure 2.)

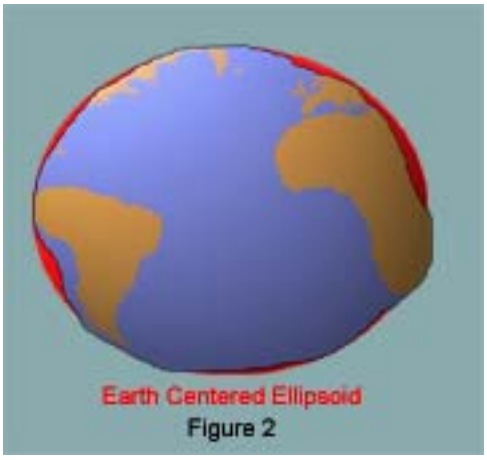

Figure 2

Horizontal Datums

The next article will discuss the subject of horizontal datums and earth reference frames.